Incubator embedded cell culture imaging system (EmSight) based on Fourier ptychographic microscopy.

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Public Summary:
Multi-day tracking of cells in culture systems can provide valuable information in bioscience experiments. We report the development of a cell culture imaging system, named EmSight, which incorporates multiple compact Fourier ptychographic microscopes with a standard multiwell imaging plate. The system is housed in an incubator and presently incorporates six microscopes. By using the same low magnification objective lenses as the objective and the tube lens, the EmSight is configured as a 1:1 imaging system that, providing large field-of-view (FOV) imaging onto a low-cost CMOS imaging sensor. The EmSight improves the image resolution by capturing a series of images of the sample at varying illumination angles; the instrument reconstructs a higher-resolution image by using the iterative Fourier ptychographic algorithm. In addition to providing high-resolution brightfield and phase imaging, the EmSight is also capable of fluorescence imaging at the native resolution of the objectives. We characterized the system using a phase Siemens star target, and show four-fold improved coherent resolution (synthetic NA of 0.42) and a depth of field of 0.2 mm. To conduct live, long-term dopaminergic neuron imaging, we cultured ventral midbrain from mice driving eGFP from the tyrosine hydroxylase promoter. The EmSight system tracks movements of dopaminergic neurons over a 21 day period.

Scientific Abstract:
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